Remarks- Examination Report

1. The Information Disclosure Statement filed April 10, 2003 fails to comply with 37 CFR 1.97(c) because it lacks a statement as specified in 37 CFR 1.97(e). Such statement cannot be made because it asserts that Applicant did not know of the reference more than 3 months prior to April 10, 2003. This reference was authored by Applicant in November 1987. Applicant considers the reference submitted on April 10, 2003 to not be pertinent to the claimed invention. Furthermore, Applicant considers this reference to not be pertinent in view of previously submitted prior-art references that contain similar subject matter.
2. The Information Disclosure Statement filed April 10, 2003 fails to comply with 37 CFR 1.97(c) because it lacks the fee set forth in 37 CFR 1.17(p).
3. A proposed drawing correction is included in response to the objection to Fig. 1.
4. The specification was amended to correct the informality noted by the Examiner.
5. The basis for rejection under 35 USC 112 is noted.
6. Claims 30-97 were rejected under 35 USC 112.
   In particular, the Claims were rejected on the basis of the specification being deficient in the manner and process of making and using the invention (the enablement requirement).
7. The Examiner states that the configuration of claims 30-97 does not correspond to the disclosure of the drawings.

   In discussions relating to actions under 35 USC 112, MPEP 2163, Section 1, Paragraph 3 states, "An applicant shows possession of the claimed invention by describing the claimed invention with all of its limitations using such descriptive means as **words, structures, figures, diagrams,** and **formulas** that fully set forth the claimed invention. *Lockwood v. American Airlines, Inc.,* 107 F.3d 1565, 1572, 41 USPQ2d 1961, 1966 (Fed. Cir. 1997)."

   In contrast, the Examiner has based the rejection of the claims under 35 USC 112 solely on the labels of the **figures**. This rejection fails to consider the description of

the invention, the functional descriptions of the elements shown in the drawings, definitions, mathematical formulas, and disclosures incorporated by reference.

MPEP 2164.01(b) states, "As long as the specification discloses at least one method for making and using the claimed invention that bears a reasonable correlation to the entire scope of the claim, then the enablement requirement of 35 U.S.C. 112 is satisfied. *In re Fisher*, 427 F.2d 833, 839, 166 USPQ 18, 24 (CCPA 1970)."

Such disclosure encompassing the methods and apparatus of the claimed invention are made in the lengthy specification and include detailed descriptions of preferred embodiments, in-depth discussions of functionality associated with the components and steps of the preferred embodiments, multiple alternative aspects and embodiments, and descriptive mathematical formulas.

8. The Examiner states that the specification fails to describe which part of the array processor shown in Fig. 1 is a pulse generator.
9. In fact, the specification clearly identifies the FSFC 100 as a pulse generator.
   - It is well known in the prior art that the FSFC 100 is a pulse generator. Pertinent prior-art publications are incorporated by reference. For example, page 5, lines 1-9 of the original specification states:

     "In the thesis, "A New Method for **Generating Short Optical Pulses**," applicant describes how an optical signal propagating through a FSFC is spread in frequency to generate broadband lasing, where the amount of frequency spreading is proportional to the number of times that light circulates through the cavity. In the Applied Physics Letters article "Optical **Pulse Generation** with a **Frequency Shifted Feedback Laser**," applicant describes an interference condition in which the broadband output of the laser produces short optical pulses, which have a frequency that is related to the RF shift frequency of the AOM. The time-domain characteristics of these optical pulses are similar to RF pulse-radio emissions."

"A patent need not teach, and preferably omits, what is well known in the art." *In re Buchner*, 929 F.2d 660, 661, 18 USPQ2d 1331, 1332 (Fed. Cir. 1991); *Hybritech, Inc. v. Monoclonal Antibodies, Inc.*, 802 F.2d 1367, 1384, 231 USPQ 81, 94 (Fed. Cir. 1986), *cert. denied*, 480 U.S. 947 (1987); and *Lindemann Maschinenfabrik GMBH v. American Hoist & Derrick Co.*, 730 F.2d 1452, 1463, 221 USPQ 481, 489 (Fed. Cir. 1984).

- The specification identifies the FSFC 100 as a pulse generator, describes the functionality of the FSFC 100 as a pulse generator (both descriptively and with mathematical formulas), and asserts that a preferred embodiment of the invention employs the FSFC 100 as a pulse generator. For example, page 6, lines 13-15 of the original specification states:

  "Another objective of the invention herein disclosed and claimed is to produce a train of ultra-short RF **pulses** from a heterodyned frequency-shifted feedback cavity *(i.e., **FSFC** 100)*, thus providing a novel spread-spectrum communications format."

  Also, page 20, lines 3-17 states that the FSFC 100 generates modes and that those **modes combine to produce short time-domain pulses**. These signal waveforms are shown in the Figures, such as in Fig. 2 and Fig. 3.

  Accordingly, the specification both states that the FSFC 100 is a pulse generator and explains the functionality of the FSFC 100 in great detail so as to teach how the FSFC 100 functions as a pulse generator.

10. The Examiner states that the specification fails to describe which part of the array processor shown in Fig. 1 is a modulator coupled to the pulse generator.
11. In fact, the specification clearly describes the laser source controller 114 as a modulator that is coupled to the pulse generator (i.e., the FSFC 100). For example, page 10, line 29-page 11, line 2 states:

    "In this case, the laser source 112 is **modulated** by the **laser-source controller 114** at a data rate corresponding to an information signal to be

> transmitted. Various types of modulation may be used to produce a modulated transmit seed signal, such as AM, FM, PAM, PSK, FH, and time-offset modulation."

Clearly, the laser-source controller 114 is a modulator, as described in the specification. Similarly, page 13, lines 10-13 describes an embodiment of the invention in which the gain medium is directly **modulated by the laser source controller 114** to generate a **modulated transmit signal**. Furthermore, since the laser-source controller 114 modulates the transmit seed signal, which is coupled into the FSFC 100, the laser-source controller 114 (i.e., the modulator) is (optically) coupled to the FSFC 100.

12. The Examiner states that the specification fails to describe which part of the array processor shown in Fig. 1 is a frequency selector.
13. In fact, the specification describes the optical-to-RF signal converter 120 (as well as the optional use of other frequency-selector components) as a frequency selector. For example, page ~~20~~ 22, lines 20-30 of the specification states:

> "In the case where the excitation distribution sequence w(n) is controlled within the FSFC 100 (for example, this would be done in an active FSFC 100, which contains a gain medium), a frequency-discrimination device may be used, such as a thin etalon (not shown) or an optical filter (not shown), that provides variable attenuation with respect to wavelength. Also, a spatial filter (not shown) or mask (not shown) may be used inside the cavity 100 to attenuate certain frequencies of light relative to their spatial relationships inside the cavity 100. The optical-to-RF signal converter may use a window filter to taper the optical distribution input into the converter or taper the RF distribution of the RF signal output from the converter. Other window filters such as frequency-selective or spatially selective variable gain or other forms of amplitude control may be applied to signals after being coupled out of the cavity 100."

Accordingly, the specification describes a broad range of filters that can be used in the apparatus shown in Fig. 1:

- An intra-cavity frequency-discrimination device (e.g., an etalon), which is shown and described in the following publications that are incorporated by reference: "***A New Method for Generating Short Optical Pulses***", Thesis of Steve J Shattil, 1987, Colorado School of Mines, and "***Optical Pulse Generation with a Frequency Shifted Feedback Laser***," Applied Physics Letters, 1988.
- Intra-cavity spatial filters or masks, which are well known in the art.
- The optical-to-RF signal converter 120 employing a window filter.
- External-cavity filters, such as frequency-selective or spatially selective variable gain or other forms of amplitude control which may be applied to signals after being coupled out of the cavity 100.

14. The Examiner asks which parts shown in Fig. 1 are the filters described in the specification.
15. The specification teaches to add filters (not shown) to the apparatus shown in Fig. 1 (e.g., an etalon, an optical filter, an FIR filter, a spatial filter, a mask), as well as to adapt some of the shown elements shown in Fig. 1 (e.g., the AOM 107, the injection source 110, the optical-to-RF signal converter) to perform filtering.

> "Some other types of tapered window sequences used in finite impulse response (FIR) filter design that are also applicable to the present invention include triangular (Bartlett), Hamming, Kaiser, Chebyshev, and Gaussian windows. In the case where the excitation distribution sequence w(n) is controlled within the FSFC 100 (for example, this would be done in an active FSFC 100, which contains a gain medium), a frequency-discrimination device may be used, such as a thin etalon (not shown) or an optical filter (not shown), that provides variable attenuation with respect to wavelength. Also, a spatial filter (not shown) or mask (not shown) may be used inside the cavity 100 to attenuate certain frequencies of light relative to their spatial relationships inside the cavity 100. The optical-to-RF signal converter may use a window filter to taper the optical distribution input into the converter or taper the RF distribution of the RF signal output from the

converter. Other window filters such as frequency-selective or spatially selective variable gain or other forms of amplitude control may be applied to signals after being coupled out of the cavity 100."

Explicitly showing some of these filters in Fig. 1 would place these filters within the block of the FSFC 100 or another component shown.

16. The Applicant was requested to point out exactly where in the specification each claim limitation is supported.
17. Descriptions in the specification supporting the independent claims 30-33 are provided in sections 9, 11, and 13 of this letter.
18. The ~~in~~dependent claims (Claims 34 to 97) are supported by the disclosure.

Providing modulation of the carriers and pulses with at least one information signal, such as described in Claims 34, 35, 37, 66, 67, 69, 82, 83, and 85 is disclosed in the specification, such as on page 10, line 29 to page 11, line 2 and on page 13, lines 10-13.

Modulating the carriers with information symbols having durations of up to the pulse period, such as described in Claims 36, 52, 68, and 84 is described in the specification, such as on page 23, lines 19-27.

Providing coding to the carrier, such as described in Claims 38, 54, 70, and 86, is disclosed in the specification, such as on page 21, lines 15-24.

Providing multiple carriers and combining the carriers to produce at least one pulse waveform, such as recited in Claims 39, 55, 71, and 87, is described throughout the specification, such as with respect to FIGs. 2 and 3, and on page 20, lines 3-17.

Providing transmit carrier frequencies that are RF, intermediate frequency, or optical frequencies, as recited in Claims 40, 56, 72, and 88, is described in the specification, such as on page 15, lines 5-13.

Generating a pulse train, such as recited in Claims 41, 57, 73, and 89, is described throughout the specification, such as on page 19, lines 14-17, and described with respect to FIGs. 7A, 7B, 9B, 10B, 11B, and 12B.

Providing a frequency-domain window, such as recited in Claims 42, 43, 58, 59, 74, 75, 90, and 91, is described throughout the specification, such as on page 22, lines 3-20.

Providing the carriers with a time-domain frequency variation, such as described in Claims 44, 60, 76, and 92, is described in the specification, such as on page 25, lines 18-25, and on page 30, lines 6-10.

Providing for frequency division multiple access, time division multiple access, and code division multiple access such as recited in Claims 45, 61, 77, and 93, is described in the specification, such as on page 24, lines 7-10, page 25, lines 1-8, and page 21, lines 15-24.

Providing coded time offsets to the carriers, such as recited in Claims 46, 62, 78, and 94, is described in the specification, such as on page 25, lines 12-17.

Allocating a predetermined set of carrier frequencies to a particular user, as recited in Claims 47, 63, 79, and 95, is described in the specification, such as on page 25, lines 1-8.

A coupler to a communication channel, such as described in Claims 48, 49, 64, 65, 80, 81, 96, and 97, is presented as an antenna array in the specification, such as shown in FIG. 1 and described on page 9, lines 21-22.

19. The objection to Claim 32 use of the phrase "a plurality of unmodulated pulses" was addressed in a claim amendment herein that removes the phrase.
20. Support for the claimed subject matter in the dependent claims 34-97 (the modulator, coder, carrier generator, and combiner) is supported in the specification, such as described in section 18 of this letter.

21. Section 7 of the Examination Report recites 35 USC 102(b) as the basis for claim rejections.
22. Claims 30-97 were rejected under 35 USC 102(b) as being anticipated by Johnson (US Pat. 5,309,514).

23. Applicant submits that the above-recited pulse generator adapted to generate and sum a plurality of carrier signals with respect to at least one predetermined phase relationship to produce the periodic pulses, as stated in the amended independent claim 30 (and hence, in the dependent claims 34-49), clearly presents novel structure that the prior-art references neither describe nor anticipate. Thus, the amended independent claim 30, (and hence, the dependent claims 34-49) should be considered patentable under 35 U.S.C. 102.

24. Applicant submits that the above-recited pulse generator capable of generating a plurality of periodic pulses having a frequency spectrum comprising a plurality of carrier signals having equally spaced frequencies and modulator adapted to modulate at least one information signal onto at least one of the periodic pulses, as stated in the independent claim 31 (and hence, in the dependent claims 50-65), clearly presents novel structure that the prior-art references neither describe nor anticipate. Thus, the independent claim 31, (and hence, the dependent claims 50-65) should be considered patentable under 35 U.S.C. 102.

25. Applicant submits that the above-recited step of providing for generating a plurality of information-modulated periodic pulses including generating a plurality of carrier signals having equally spaced carrier frequencies, summing the carrier signals to generate periodic pulses having at least one pulse period, and modulating information onto the periodic pulses, the information-modulated periodic pulses having at least one of a set of signal characteristics that is a function of at least one information signal, the set of signal characteristics including amplitude, phase, time, and frequency, as stated in the amended independent claim 32 (and hence, in the dependent claims 66-81), clearly presents novel method that the prior-art references

neither describe nor anticipate. Thus, the amended independent claim 32, (and hence, the dependent claims 66-81) should be considered patentable under 35 U.S.C. 102.

26. Applicant submits that the above-recited step of providing for generating a plurality of periodic pulses wherein the periodic pulses have at least one pulse period and a frequency spectrum comprising a plurality of carrier signals having equally spaced frequencies, and providing for modulating the periodic pulses with at least one information signal to generate a plurality of information-modulated periodic pulses, as stated in the independent claim 33 (and hence, in the dependent claims 82-97), clearly presents novel method that the prior-art references neither describe nor anticipate. Thus, the amended independent claim 33, (and hence, the dependent claims 82-97) should be considered patentable under 35 U.S.C. 102.

27. Specifically, the claimed invention purposely uses interfering carriers to generate pulse waveforms that are localized in time. This is particularly novel and useful in multicarrier communications wherein modulation of the inventive waveforms provides substantial advantages, including spread spectrum characteristics and low dynamic range.

28. By providing combining the carrier signals to generate at least one pulse waveform, the invention achieves the following unique consequences:
    a. It spreads information over multiple carriers, thus providing superior frequency diversity via redundancy.
    b. It shapes superpositions of the carriers to produce pulse waveforms, which can provide the information symbols with orthogonality in time.
    c. It enables multiple information symbols and/or users to share the same frequencies, thus providing combined, and typically contradictory, benefits of frequency diversity and bandwidth efficiency.

29. No other prior-art reference produces pulse waveforms from superpositions of carriers. No other prior-art reference modulates information onto pulse waveforms

generated from multiple carriers. No other prior-art reference combines carriers in a way that produces signals that are orthogonal in time. Accordingly, no other prior-art reference generates multicarrier signals that map information symbols to pulse waveforms generated from superpositions of the carrier signals.

30. **None of the prior-art references teach to generate pulse waveforms from superpositions of carrier signals. None of the prior-art references teach to combine carriers in a way that produces pulses that are orthogonal in time. None of the prior-art references teach to encode a multicarrier signal with complex weights that map information symbols to pulse waveforms generated from carrier superpositions.**

In Johnson, the **pulses are not constructed from a selection of subcarriers.** Similarly, the pulses are not produced for the purpose of generating subcarriers. Rather, a logic gate 45 produces a square-wave pulse (i.e., a time-domain pulse), which is shaped by a sine squared shaping filter 50 (col. 1, lines 52-67 and shown in Fig. 3A).

Johnson **does not show information modulated onto pulses having a frequency spectrum of equally spaced carriers**. Although the Johnson reference refers to the pulses as "information" or "data", information is not actually modulated onto the pulses. Rather, it appears that the pulses are used for timing or descrambling (such as described in col. 2, lines 10-37). In particular, control circuit 40 generates control signals in accordance with data to be transmitted (col. 1, lines 57-59). In this particular apparatus, neither amplitude modulation nor phase modulation can be employed. Apparently, only the pulse frequency can be altered. If the frequency of the control signals (and hence the pulse frequency) are changed, the pulses will not be periodic. Therefore, **the spectrum of the pulses cannot be comprised of carriers with equally spaced frequencies**. In particular, data pulses illustrated in Fig. 6B (and described in col. 5, lines 44-64) are clearly not periodic. Therefore, the spectrum of the data-bearing pulses is not comprised of equally spaced carrier frequencies.

In Johnson, a pulse modification circuit 68 shifts the level of the square wave to provide different amplitudes (col. 2, lines 44-49) to thwart unauthorized terminal units from descrambling the television signal, such as described in col. 2, lines 10-37. The pulses are amplitude modulated onto a carrier (col. 2, lines 54-56).

31. The Novel Physical Feature of the Independent Claims Provides New and Unexpected Results and Hence Should Be Considered Non-obvious, Making the Independent Claims 30-33 (and hence, Dependent Claims 34-97) Patentable Under 35 U.S.C. 103.

32. Although Johnson teaches to store a plurality of wave shapes 100, 105, 110, 115, 120, 125, 130, and 135 having desired (i.e., in-band) spectral characteristics, the implementation of time-domain pulse generation and the use of non-periodic pulse waveforms for data can have undesirable (i.e., out-of-band) spectral consequences when a sequence of such wave shapes is constructed. Such consequences, which are unforeseen in Johnson, result from pseudo-periodic high-frequency pulse patterns occurring across adjacent wave shapes. For example, Johnson teaches to filter out the fifth harmonic of pulses modulated at the line rate in order to mitigate out-of-band leakage into the second audio subcarrier. However, Johnson shows a pulse-offset modulation that is not periodic, and thus, does not have a fifth harmonic. Johnson fails to show any method for mitigating out-of-band leakage resulting from resonances between pulses in adjacent wave shapes. The non-periodic data pulses can cause inter-waveshape resonances that cannot be filtered using the techniques taught in Johnson. Alternatively, the periodic pulse waveforms having equally spaced carriers (such as recited in the claims of Applicant's invention) solve this unforeseen problem by limiting the effects of inter-pulse resonances, and can improve the invention described in Johnson.

33. None of the prior-art multi-carrier communication systems can provide these New and Unexpected results.

34. Neither Johnson nor any combination of prior-art references can provide these new and unexpected benefits.

35. Because the novel physical features of Applicant's invention provide these new and unexpected results over any reference, and the addition of Applicant's device to prior-art signal-processing systems results in a substantial improvement in the performance of these systems, Applicant submits that these new results indicate non-obviousness of the novel physical features and hence, patentability. Accordingly, Applicant respectfully requests reconsideration and allowance of the present application with the above claims.

36. As detailed above, the cited art describes a different type of signal processing to that claimed by the present invention. Although different to the present invention, such signal-processing protocols have use, as is evidenced by the teaching of the prior art. Such use is served by the Johnson protocol for transmitting timing and scrambling signals, and there is no teaching in the prior art to change the type of signal-processing protocol provided so as to resemble or reflect that of the present invention. As there is no motivation to change, no teaching to change, and no description of how any change may be made to produce the multicarrier processing protocol or apparatus disclosed in Applicant's invention, it is submitted that the presently claimed invention is also non-obvious, making the claims patentable under U.S.C. 103.

The Cited but Non-Applied References

37. These subsidiary references have been studied, but are submitted to be less relevant than the relied-upon references.

Bocchi (US Pat. 4,590,511) relates to a television camera adapted to provide image processing that distinguishes between different colors. A color converter includes a phase encoder that provides a greyscale analog of hue components of a camera signal.

The phase encoder includes pulse generators that produce signals to control an integrator.

Stoffer (US Pat. 5,463,376) describes an article surveillance system that detects a resonant tag between transmitting and receiving antennas. The transmitting antenna produces a swept electromagnetic field. Phase shifting networks are employed to optimize coupling between the transmitting and receiving antennas. The detected signal is processed by a pulse detector that searches for pulses occurring at the sweep frequency. Pulses occurring at other frequencies are considered to be interference and are filtered out.

38. Conclusion

The Applicant submits that every effort has been made to address the Examiner's objection and that the Application is now in condition to proceed to grant.

Drawings: Remarks

A proposed correction to drawing sheet 1 is included, as required by the Examiner.

In particular, the apparatus shown in Fig. 1 was changed to accommodate labels for the injection source 110, source controller 112, laser source 114, FSFC 100, cavity-length adjustment device 109, AOM 107, RF source 108, transducer 106, receiver network 140, demultiplexer 146, receiver 148, combiner 144, RF-to-optical converter 120, optical-to-RF converter 120, demultiplexer 122, reference source 121, photodiode array (PDA) 126, transmit/receive coupler array 130, and antenna array 150.

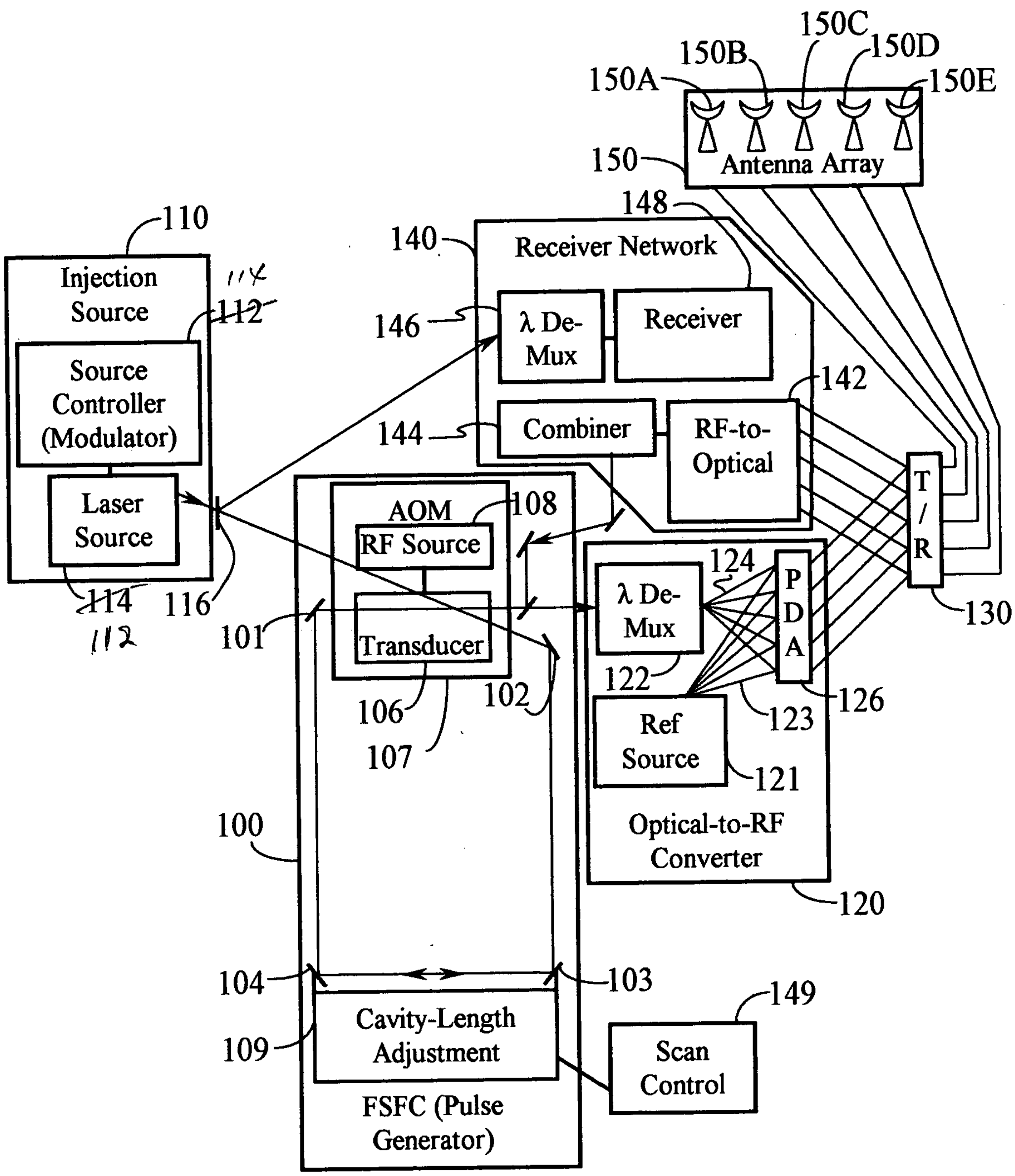
150A
150B
150C
150D
150E
150
Antenna Array
148
140
Receiver Network
110
Injection Source
114
~~112~~
Source Controller (Modulator)
146
λ De-Mux
Receiver
142
144
Combiner
RF-to-Optical
Laser Source
AOM
108
RF Source
124
T / R
λ De-Mux
P D A
~~114~~
112
116
101
Transducer
130
122
126
123
106
102
107
Ref Source
121
100
Optical-to-RF Converter
120
104
103
149
Cavity-Length Adjustment
109
Scan Control
FSFC (Pulse Generator)

FIG. 1

Remarks: Claims

In Claim 30, the description of the pulse generator being adapted to generate and sum a plurality of carrier signals with respect to at least one predetermined phase relationship to produce the periodic pulses is supported in the specification, such as on page 18, line 19- page 20, line 17.

Similarly, in Claim 32, the added description of generating a plurality of carrier signals having equally spaced carrier frequencies, and summing the carrier signals to generate periodic pulses having at least one pulse period is also supported in the specification on page 18, line 19- page 20, line 17.

Very Respectfully,

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